

## **REMARKS**

Prior to this Reply, Claims 1-67 were pending. Through this Reply, Claims 8, 12, 14, 18, 36, 39, 42, 46, 52, 65 and 67 have been amended, while Claim 66 has been cancelled. No claims have been added. It should be noted that Claims 8, 12, 14, 18, 36, 39, 42, 46 and 52 were amended to correct obvious grammatical or typographical errors and not to overcome any of the cited references. Accordingly, Claims 1-65 and 67 are now at issue in the present case.

### **I. Claim Objections**

The Examiner objected to Claims 28 and 29 as not clearly delineating the claimed invention. Applicants respectfully disagree.

Specifically, Applicants note that according to Claim 28, zones on different storage media are considered (e.g., zones on different storage media forming a cylinder) whereas, according to Claim 29, zones on the same storage media are considered. Accordingly, Applicants believe that the Examiner's objection should be withdrawn.

### **II. Rejections Under 35 U.S.C. § 112**

The Examiner rejected Claims 25 and 58 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Specifically, the Examiner stated that he does not understand the limitations of Claims 25 and 58.

Claim 25 specifies that steps of Claim 24 are repeated for read/write frequencies beyond the one read/write frequency specified in Claim 24. Claim 58 specifies similar limitations with

respect to Claim 57. Applicants respectfully submit that the rejection of Claims 28 and 58 under 35 U.S.C. § 112, second paragraph, should be withdrawn.

### **III. Allowable Subject Matter**

The Examiner objected to Claims 5, 7, 10-12, 16, 22, 26, 27, 31, 35, 37, 41, 44-47, 50, 59, 61 and 66 as being dependent on a base rejected claim. However, the Examiner indicated that such claims would be allowable if rewritten in independent form to include all of the limitations of their respective base claims and any intervening claims.

In response, Applicants have amended Claim 65 to include the limitations of objected-to Claim 66. Accordingly, Claim 66 has been cancelled.

### **IV. Rejections Under 35 U.S.C. § 102(b)**

The Examiner rejected Claims 62-65 and 67 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,137,644 to Hetzler et al. ("Hetzler"). Applicants respectfully traverse the rejection of Claims 62-65 and 67 because Hetzler does not disclose all of limitations in such claims.

With respect to Claim 62, Hetzler (Col. 9, lines 6-18, which is relied on by the Examiner) does not disclose that: "each storage media includes the same number of concentric zones as other storage media in that data storage device, wherein the boundaries of radially similarly situated zones on all the storage media in that data storage device are at the same radial locations," as required by Claim 62. Hetzler only mentions that track density or ECC bytes can be varied, nothing more. For example, Hetzler does not require that the boundaries of radially similarly situated zones on all the storage media in that data storage device are at the same radial

locations. For at least this reason, Applicants believe that Claim 62, and all claims that depend therefrom, are patentably distinguishable from Hetzler.

With respect to Claim 63, again, Hetzler suggests that track density or ECC bytes can be varied. However, Hetzler does not disclose that “radially similarly situated zones on all the storage media include the same number of concentric tracks” as required by Claim 63. For at least this reason, Applicants believe that Claim 63 is patentably distinguishable from Hetzler.

Similarly, with respect to Claim 64, once again, Hetzler suggests that track density or ECC bytes can be varied. However, Hetzler does not disclose that: “at least a number of radially similarly situated zones on all the storage media include different number of concentric tracks,” as required by Claim 64. For at least this reason, Applicants believe that Claim 64 is patentably distinguishable from Hetzler.

With respect to Claim 67 (as amended), Hetzler does not disclose that “at least a number of sequentially similarly situated zones on all the storage media include different number of concentric tracks” as required by Claim 67. For at least this reason, Applicants believe that Claim 67 is patentably distinguishable from Hetzler.

## **V. Rejections Under 35 U.S.C. § 103(a)**

The Examiner rejected Claims 1-4, 6, 8, 9, 13-15, 17-21, 23-24, 28-30, 32-34, 36, 38-40, 42, 43, 48, 49, 51-57 and 60 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,182,250 to Ng (hereinafter “Ng”). Applicants respectfully traverse the rejections because a prima facie case of obviousness has not been established.

With respect to Claim 1, Ng does not disclose the steps of: “*for a sample number of data storage devices, measuring a performance of each head in the sample number of data storage*

devices at one or more read/write frequencies per zone,” as required by Claim 1 (emphasis added). Further, Ng does not disclose the steps of: “*for said multiple data storage devices, based on said performance measurements, jointly*: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and *allocating one or more of the heads in each of the multiple data storage devices* to each frequency in said group of frequencies per zone;” and “in each of said multiple data storage devices, assigning one of said frequencies to each head per zone, based on capability of that head,” as required by Claim 1 (emphasis added).

The Examiner contends that Ng discloses measuring head performance per zone and performing head assignment per zone, and that it would have been obvious to perform such steps for a number of data storage devices, rendering the claimed invention obvious. This contention is respectfully traversed for at least the following reasons.

It is respectfully submitted that (1) not only the method of Ng is inherently different from the claimed invention, but also (2) it cannot be modified as suggested by the Examiner to achieve the claimed invention. This is because Ng is directed to implementation of variable bit density recording in a storage disc drive based on head performance information from only that disk drive. In contrast, Claim 1 is directed to a method of defining a storage format in each of multiple data storage devices based on head performance information from the multiple data storage devices.

In contrast to the Examiner’s assertion, the invention of Claim 1 cannot be achieved by simply repeating the method of Ng multiple times. This is because, according to the invention of Claim 1, the performance information from the multiple storage devices is used in defining the storage format of each of the multiple storage devices.

Ng in no way discloses or suggests using performance data from multiple unrelated storage devices to define the storage format of a storage device. Applicants submit that the Examiner has failed to establish a prima facie case of obviousness because he has failed to provide a reference that discloses all of the limitations of Claim 1. For example, there is no mechanism disclosed by Ng, or the Examiner, that jointly uses head performance information from multiple disk drives in defining the storage format of each of the multiple disk drives.

A brief description of one embodiment of the present invention is provided here to further clarify the above-mentioned differences between the claimed invention and Ng. According to one embodiment of the present invention, a population of disk drives is selected and head performance measurements are taken for each selected media surface location at different frequencies in the disk drives. Performance distributions are obtained from the measured data, and these distributions are used to obtain a design of different frequencies across the media surface zones, and to determine head allocation. Once the different frequencies for the zones have been determined, then in each disk drive, the heads are assigned to the predetermined frequencies. This allows maintaining consistent performance (both sequential and random throughput) across a population of disk drives, and reduces test time.

In one version, the density/format for each recording surface zone (and the number of heads allocated to each density) are preselected at design time and, at manufacturing time, heads are assigned to higher/lower density formats. Unlike Ng, head allocation is based on head performance in multiple disk drives and head assignment is per head per zone, taking into consideration head performance variation across zones. In one example head assignment step, if a first head performs well at inner disk diameter (ID) but performs poorly at outer disk diameter (OD), and if a second head has the reverse performance, that performance difference is traded off

by: assigning the first head to high density at ID and to low density at OD, and assigning the second head to low density at ID and to high density at OD.

As such, in one embodiment the present invention provides a variable BPI storage format as a function of storage zones in disk drives, based on transducer head performance variations between different heads in a set of disk drives. An example method of defining such a storage format in multiple data storage devices is provided by Claim 1. By contrast, for each disk drive, Ng uses the head performance data for that disk drive to implement variable bit density recording.

The above-described embodiment of the present invention cannot be achieved by simply repeating the method of Ng multiple times. According to one embodiment of the present invention, the performance information from the multiple drives is used (e.g., using joint optimization) to define the storage format of each of the multiple drives. However, Ng does not disclose or suggest using performance data from multiple drives to define storage format of a drive. Further, the Examiner has not provided any reference that discloses such a limitation.

In light of the above, Applicants believe that Claim 1, and the claims that depend therefrom, are patentably distinguishable from Ng. Similarly, Applicants believe that Claims 39 and 42, and the claims that depend therefrom, are patentably distinguishable from Ng.

Regarding Claims 8 and 32, Ng does not disclose calibrating multiple storage devices for head performance measurements that are used to define storage format of each storage device. Further, as discussed in relation to Claim 1, Ng only deals with one disk drive at a time based on head performance information in that disk drive only.

Regarding Claims 9, 13 and 43, Ng (Col. 5, line 62 to Col. 6, line 5, relied on by the Examiner) does not disclose jointly selecting frequencies and allocating heads to frequencies to

satisfy a specified constraint, based on performance data from multiple storage devices.

Furthermore, Ng does not disclose jointly satisfying a constraint for multiple storage devices, wherein the constraint is storage capacity. Even further, as discussed in relation to Claim 1, Ng only deals with one disk drive at a time based on head performance information in that disk drive only.

Regarding Claims 14 and 48, Ng (Col. 5, line 62 to Col. 6, line 1, relied on by the Examiner) does not disclose a constraint of providing storage device yield for multiple data storage devices because Ng only deals with one disk drive at a time.

Regarding Claims 15 and 30, Ng does not disclose a joint constraint of maximizing data storage yield while providing a specified data storage capacity for the multiple data storage devices, based on performance information from multiple data storage devices. Further, as discussed in relation to Claim 1, Ng only deals with one disk drive at a time based on head performance information in that disk drive only.

Regarding Claims 17 and 51 (Col. 5, lines 50-58 and Col. 10, lines 6-7, relied on by the Examiner), Ng does not disclose determining distributions based on performance information from multiple data storage devices. Ng does not disclose: for said multiple data storage devices based on said performance distributions, jointly selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone. Further, as discussed in relation to Claim 1, Ng only deals with one disk drive at a time based on head performance information in that disk drive only.

Regarding Claims 18, 20, 21, 52, 54 and 55, Ng (Col. 5, lines 50-58, and Col. 5, line 58 to Col. 6, line 9, relied on by the Examiner), does not disclose or suggest generating performance

distributions from multiple data storage devices. Ng does not disclose or suggest estimating a record/play back frequency of each head based on the performance distributions. Furthermore, Ng does not disclose generating record/playback frequency capability distributions of the heads based on said estimate from multiple storage devices. Even further, as discussed in relation to Claim 1, Ng only deals with one disk drive at a time based on head performance information in that disk drive only.

Regarding Claims 24 and 57, Ng (Col. 5, lines 50-51; Col. 10, lines 6-7; and, Col. 6, lines 16-33, relied on by the Examiner) does not disclose or suggest ranking, allocating and assigning head frequencies based on performance data from multiple data storage devices. Further, as discussed in relation to Claim 1, Ng only deals with one disk drive at a time based on head performance information in that disk drive only.

Regarding Claim 28, Ng (Col. 5, lines 39-40, relied on by the Examiner) does not disclose obtaining head performance information in different zones from multiple unrelated data storage drives. Further, as discussed in relation to Claim 1, Ng only deals with one disk drive at a time based on head performance information in that disk drive only.

Regarding Claims 49 and 60, Ng (Col. 6, lines 4-5, relied on by the Examiner) does not disclose a joint constraint of maximizing data storage yield while providing a specified data storage capacity for the multiple data storage devices. Further, as discussed in relation to Claim 1, Ng only deals with one disk drive at a time based on head performance information in that disk drive only.

For at least the above reasons, Applicants submit that the rejections under 35 U.S.C. § 103 should be withdrawn.



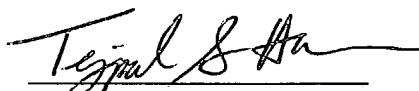
**VI. Conclusion**

Applicants believe that no additional fees are due. Nevertheless, the Commissioner is hereby authorized to charge Deposit Account No. 50-2198 for any fee deficiencies associated with filing this paper.

Applicants believe that the application appears to be in form for allowance. Accordingly, reconsideration and allowance thereof is respectfully requested.

The Examiner is invited to contact the undersigned at the below-listed telephone number regarding any matters relating to the present application.

Respectfully submitted,



Tejpal S. Hansra  
Registration No. 38,172  
Hansra Patent Services  
4525 Glen Meadows Place  
Bellingham, WA 98226  
(360) 527-1400

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